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The role of geometrical construction in Theodosius's *Spherics*. (English)

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As is well known, the propositions of Euclid's Elements fall in two classes: theorems and problems, where the latter show how to construct a requested mathematical object, e.g. (I.1), an equilateral triangle with a given side. The proofs of these construction as well as those of many theorems also contain constructions, namely if entities are to be made use of that are not given in or directly implied by the enunciation; often, these two types of constructions have been conflated in discussions.

Theodosius's Spherics, a treatise dealing with the geometry of the sphere, starting with elementary propositions and ending with matters of genuine astronomical interest, is similarly structured in theorems and problems, and constructions have the same dual role. However, the particular character of the object a sphere whose interior is not directly accessible for manipulation (if we think with Aristotle of it as the result of an abstraction process, where materiality has been removed from a bronze sphere) allows the authors to make observations that distinguish the constructions that are solutions to problem from those performed in proofs (proofs for theorems as well as proofs for the correctness of problem solutions). The latter may well ask for operations that are purely theoretical (cutting the sphere by a plane though its centre as a way to construct a great circle, etc.), since the function of entities constructed in this way is merely to allow the argument to draw on their well-known properties; the former (with one exception, I.2, "to find the centre of a given sphere", used in a particular way in the following and anyhow not possible in a material sphere) always restrict themselves to operations that can be performed with ruler and compass on the surface of the sphere and in a plane support for auxiliary constructions. Once such a problem has been solved, the entity it has shown how to construct (e.g., in I.19, the diameter of a given sphere) can be used freely in the ensuing deductive structure as it also happens in the Elements; this observation casts new light on the standard phrase "let [something] have been drawn/constructed".

As argued in the concluding part of the article (which draws further support from Vitruvius, Ptolemy, Geminus, Hero and Pappus), this suggests that "geometric problems originated in the practical issues involved in actually making diagrams"; that the constructions of the theoretical works are "abstractions of these processes, that are used to introduce objects not given at the outset, so that their properties can be used in the argument"; and that "ancient mathematicians were interested in developing methods that directly modeled the possible operations of actual instruments".

The presentation builds on a thorough presentation of Theodosius's treatise, in particular examination of all the problems it contains, with much attention to the vocabulary that is used.

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Classification :

∗01A20 Greek or Roman mathematics